Result Summary for the Area 5 Radioactive Waste Management Site Performance Assessment Model Version 4.110

Results for Version 4.110 of the Area 5 Radioactive Waste Management Site (RWMS) performance assessment (PA) model are summarized. Version 4.110 includes the fiscal year (FY) 2010 inventory estimate, including a future inventory estimate. Analyses are summarized in Table 1.

Table 1. Summary of analyses

Inventory	Analysis	Realizations
Post-1988, Future	Member of Public, Intruder, Radon Flux	5,000
Pre-, Post-1988, and Future	Member of Public	5,000

Version 4.110 was implemented in GoldSim 10.11(SP4). The following changes have been implemented since the last baseline model, Version 4.105:

- Updated the inventory and disposal unit configurations with data through the end of FY 2010.
- Implemented Federal Guidance Report 13 Supplemental CD dose conversion factors (U.S. Environmental Protection Agency, 1999).

Performance Assessment Results

Version 4.110 PA results comply with air pathway and all-pathways annual total effective dose (TED) performance objectives (Tables 2 and 3, Figures 1 and 2). Air pathways results decrease moderately for all scenarios. The time of the maximum for the air pathway open rangeland scenario shifts from 1,000 to 100 years (y). All-pathways annual TED increases for all scenarios except the resident scenario.

Table 2. Member of public annual TED through the air pathway

Exposure Scenario	Mean (mSv)	95 th Percentile (mSv)	Time of Maximum
Transient Visitor	4.8E-5	1.9E-4	1,000 years
Resident	1.3E-4	5.3E-4	1,000 years
Resident Farmer	1.8E-4	6.9E-4	1,000 years
Open Rangeland (Cane Spring)	6.5E-9	NA	100 years
Open Rangeland (NNSS Boundary)	8.9E-8	NA	100 years

NA – not available, insufficient non-zero values to calculate 95th percentile

NNSS – Nevada National Security Site

The maximum member of public all-pathways dose occurs at 1,000 y for the resident farmer scenario. The resident farmer dose was predominately due to technitium-99 (Tc-99) (82 percent) and lead-210 (Pb-210) (13 percent). Pb-210 present at 1,000 y is produced predominately by radioactive decay of uranium-234 (U-234) present at the time of disposal.

Table 3. Member of public annual TED through all-pathways

Exposure Scenario	Mean (mSv)	95 th Percentile (mSv)	Time of Maximum
Transient Visitor	3.8E-3	8.4E-3	1,000 years
Resident	6.6E-4	2.4E-3	1,000 years
Resident Farmer	1.7E-2	5.3E-2	1,000 years
Open Rangeland (Cane Spring)	2.8E-3	NA	100 years
Open Rangeland (NNSS Boundary)	3.0E-3	NA	100 years

NA – not available, insufficient non-zero values to calculate 95th percentile

All results for the postdrilling and intruder-agriculture scenarios comply with the performance objectives (Tables 4 and 5, Figures 3 and 4). The postdrilling intruder results are similar to Version 4.105 results. The intruder-agriculture results are similar to Version 4.105, except for the Pit 6 Radium Disposal Unit (RaDU). The intruder-agriculture result for the Shallow Land Burial (SLB) disposal units is a significant fraction of the performance objective and exceeds the performance objective at the 95th percentile. The intruder-agriculture dose is due predominantly to Tc-99 (75 percent) and U-238 (9.5 percent).

Table 4. Postdrilling intruder TED weighted by the probability of occurrence

Disposal Unit	Mean (mSv)	95 th Percentile (mSv)	Time of Maximum
(SLB)	5.6E-3	1.8E-2	1,000 years
Pit 6 RaDU	7.4E-4	2.0E-3	1,000 years
Pit 13 RaDU	1.4E-3	3.1E-3	1,000 years
Greater Confinement Disposal (GCD)	2.9E-7	9.7E-7	1,000 years

Table 5. Intruder intruder-agriculture TED weighted by the probability of occurrence

Disposal Unit	Mean (mSv)	95 th Percentile (mSv)	Time of Maximum
SLB	0.39	1.3	1,000 years
Pit 6 RaDU	1.4E-3	4.2E-3	1,000 years
Pit 13 RaDU	7.3E-4	2.6E-3	1,000 years
GCD	3.9E-10	NA	100 years

NA – not available, insufficient non-zero values to calculate 95th percentile

The acute intruder scenario results comply with all performance objectives (Tables 6 and 7, Figures 5 and 6). The acute construction result for the SLB disposal units decreases significantly with this version. The maximum acute intruder dose occurs at 1,000 y for the SLB disposal units under the acute construction scenario. The acute intruder dose is caused by multiple radionuclides including U-238 (31 percent), Th-229 (28 percent), plutonium-239 (8.6 percent), U-233 (7.8 percent), and U-234 (6.7 percent).

Table 6. Acute drilling intruder TED

Disposal Unit	Mean (mSv)	95 th Percentile (mSv)	Time of Maximum
Shallow Land Burial (SLB)	2.1E-3	4.1E-3	1,000 years
Pit 6 RaDU	0.028	0.052	1,000 years
Pit 13 RaDU	0.026	0.034	1,000 years
GCD	0.016	0.041	1,000 years

Table 7. Acute construction intruder TED

Disposal Unit	Mean (mSv)	95 th Percentile (mSv)	Time of Maximum
SLB	1.1	2.1	1,000 years
Pit 6 RaDU	0.15	0.28	1,000 years
Pit 13 RaDU	0.060	0.19	1,000 years
GCD	2.7E-6	NA	100 years

All results for radon-222 (Rn-222) flux density comply with the performance objective (Table 8, Figure 7). The mean Pit 13 RaDU flux density is close to the $0.74 \text{ Bq m}^{-2} \text{ s}^{-1}$ limit.

Table 8. Rn-222 flux density results

Disposal Unit	Mean ($\text{Bq m}^{-2} \text{ s}^{-1}$)	95 th Percentile ($\text{Bq m}^{-2} \text{ s}^{-1}$)	Time of Maximum
All	0.13	0.27	1,000 years
SLB	0.12	0.26	1,000 years
Pit 6 RaDU	0.055	0.10	1,000 years
Pit 13 RaDU	0.69	2.0	1,000 years
GCD	1.2E-8	3.4E-8	1,000 years

The composite analysis results are less than the 0.3 mSv dose constraint (Table 9).

Table 9. Composite analysis annual TED results

Disposal Unit	Mean (mSv)	95 th Percentile (mSv)	Time of Maximum
All	8.9E-4	3.0E-3	1,000 years

Figure 1. Mean member of public TED time history for the air pathway

Figure 2. Mean member of public TED time history for all-pathways

Figure 3. Mean intruder TED time history for the postdrilling intruder scenario

Figure 4. Mean intruder TED time history for the intruder-agriculture scenario

Figure 5. Mean intruder TED time history for the acute drilling scenario

Figure 6. Mean intruder TED time history for the acute construction scenario

Figure 7. Mean Rn-222 flux density averaged over all disposal units

Figure 8. Mean composite analysis TED time history

References

U.S. Environmental Protection Agency, 1999. *Cancer Risk Coefficients for Environmental Exposure to Radionuclides*. Washington, D.C.:
U.S. Environmental Protection Agency, EPA-402-R-99-001, Supplemental CD.

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